



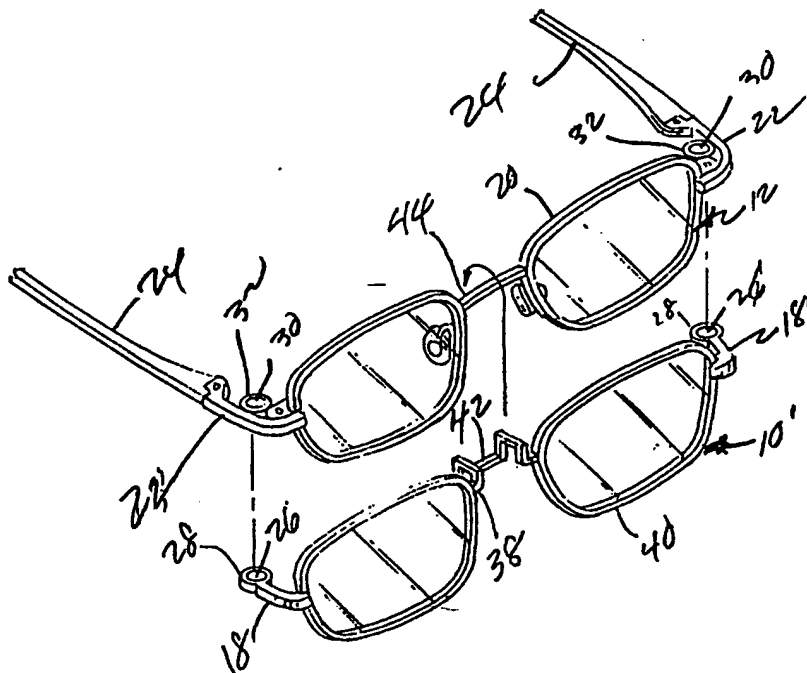
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G02C 9/00, 7/08		A1	(11) International Publication Number: WO 00/26718
			(43) International Publication Date: 11 May 2000 (11.05.00)
(21) International Application Number: PCT/US99/25420		(81) Designated States: AL, AU, BA, BB, BG, BR, CH, CN, CU, CZ, EE, GE, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LT, LV, MG, MK, MN, MX, NO, NZ, PL, RO, SG, SI, SK, SL, TR, TT, UA, US, UZ, VN, YU, ZA, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 28 October 1999 (28.10.99)			
(30) Priority Data: 09/184,694 2 November 1998 (02.11.98) US			
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(54) Title: AUXILIARY EYEWEAR ATTACHMENT METHODS AND APPARATUS

(57) Abstract

A method and apparatus for mounting auxiliary eyeglasses (10) on conventional eyeglasses (12) in which magnets are attached to appendages (18) on the auxiliary eyeglasses mating with magnets mounted on the temple extensions (22) of conventional eyeglasses. The magnets on the auxiliary eyeglasses are mounted in sockets (32) formed on the appendages of the auxiliary eyeglasses such that their maximum magnetic force is oriented vertically or parallel to the plane of the conventional eyeglass frame. The appendages (18) on the auxiliary eyeglass frame (16) fit beneath the temple extension (22) on the conventional eyeglass frame (20) to hold the auxiliary frame (16) in place solely by the magnetic attractive force. The orientation of the magnets is such that the maximum magnetic force resists any downward movement of the auxiliary eyeglasses on the conventional eyeglasses when installed. In a modification of the embodiment, a clip (42) is attached to or formed on the bridge (38) of the auxiliary eyeglasses for fitting over the bridge (44) of the conventional eyeglasses. In yet another embodiment, clips (52) are formed on the frame (54) of the auxiliary eyeglasses to fit over the frame of the conventional eyeglasses. Magnets (56) are embedded in the bridge (58) of the auxiliary eyeglasses that mate with complementary magnets (68) in the bridge (66) of the conventional eyeglasses when the bridge is slid beneath the bridge of the conventional eyeglasses.



SPECIFICATION

TITLE: AUXILIARY EYEWEAR ATTACHMENT METHODS AND APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to auxiliary eyewear attachment methods and apparatus, such as clip-on eyewear, and more particular relates to an auxiliary eye wear for attaching auxiliary sunglasses to conventional eyeglasses.

2. Background Information

Auxiliary eyewear to convert conventional eyeglasses to sunglasses are very popular. They allow the user to usually avoid the need for two separate prescription lenses. They can also be used, but less frequently, to attach auxiliary eyewear that can change the prescription of lenses. The more common use, however, is to add tinted lenses to conventional eyeglasses.

A number of different designs are available for auxiliary eyewear including clip-on eyewear, as well as auxiliary eyewear attachment using magnets. One method of attaching auxiliary eyewear is by clips. A method of attaching auxiliary eyewear by clips is shown and described in U.S. Application No. 08/510,797 filed August 3, 1995 to the same inventor as the invention disclosed herein and incorporated herein by reference. Another patent describing a clip-on type of sunglasses is disclosed and described in U.S. Patent No. 5,696,571 issued December 9, 1997 to Spencer et al. In these devices auxiliary eyewear is fastened to eyeglasses by a conventional clip system with one clipping

engaging the temple while other clips engage the conventional frame.

A newer and very popular method of attaching eyeglasses is by using magnets. One such method is disclosed and described in U.S. Patent No. 4,070,105 of Meeker. In the Meeker patent the conventional frame includes a magnetic material secured around the peripheral portion facilitating attachment of auxiliary eyeglasses to the conventional eyeglass frame.

Another method of attaching auxiliary eyeglasses using magnets is disclosed in U.S. Patent No. 5,416,537 of Sadler having magnets secured to temporal portions of a conventional frame that mate with similar magnets in auxiliary eyeglass frames. In the Meeker and Sadler patents the magnets are embedded in portions of the frames in a vertical orientation for mating with similar magnets in the auxiliary eyeglasses. A problem with this type of arrangement is that the auxiliary eyeglasses are held in place in front of the conventional eyeglasses only by the strength of the magnets. There are no supporting members to prevent the auxiliary eyeglasses from moving vertically relative to the conventional eyeglass frame. Therefore, when the auxiliary eyeglasses are used in some strenuous activity such as jogging or exercising they can slide off and become detached from the conventional frame.

A design that solves this problem by having magnets in auxiliary eyeglass extensions is disclosed and described in U.S. Patent No. 5,568,207 of Chao. In this patent the

problem of the eyeglasses sliding vertically and coming off the conventional eyeglasses is solved by extensions on the auxiliary eyeglasses having magnets that extend over (i.e. above) hinge connections for the temples of the conventional eyeglasses. Magnets in the hinge connections mate with magnets in the extensions to hold the utility eyeglasses in place in front of the conventional eyeglasses. The extensions fitting over (i.e. above) the hinge portions of the conventional eyeglasses prevent the frames from moving downward. It was thought that this combination of the extension being above the temple connection in combination with the magnet prevents the auxiliary eyeglasses from moving downward relative to the conventional eyeglasses and being dislodged during strenuous activity. That is, the patent describes the prior art as being unable to provide a practical solution to attaching auxiliary eyeglasses to conventional eyeglasses with magnets alone.

The problem with the eyeglasses disclosed and described in U.S. Patent No. 5,568,207 is that the auxiliary eyeglass extensions must be carefully placed above the temple hinge connections. This makes it little more difficult to attach the auxiliary frames to be sure that the extensions are placed carefully above the hinge connections of the conventional eyeglass. In most cases a wearer has to remove his conventional eyeglasses to attach the auxiliary lenses.

It is, therefore, one object of the present invention to provide an improved method and apparatus for attaching auxiliary eyeglasses to conventional eyeglasses.

Another object of the present invention is to provide an improved method and apparatus for attaching auxiliary eyeglasses to conventional eyeglasses with magnets alone without any need for other support.

Yet another object of the present invention is to provide a method of attaching auxiliary eyeglasses to conventional eyeglasses by appendages having magnets which fit below and mate with similar magnets in the conventional eyeglass extensions for attaching eyeglass temples.

Still another object of the present invention is to provide an improved magnetic attachment of auxiliary eyeglasses to conventional eyeglasses with magnets that are oriented to maximize the magnetic force to prevent vertical or downward movement of the auxiliary eyeglasses.

Still another object of the present invention is to provide an auxiliary eyeglass magnetic connection having magnets that are oriented horizontally to maximize the magnetic force in the vertical direction.

Still another object of the present invention is to provide an auxiliary eyeglass magnetic attachment that includes additional supporting clips, if desired.

Yet another object of the present invention is to provide auxiliary eyeglass magnetic attachment that includes a clip that conveniently fits over the bridge of conventional eyeglass frame.

BRIEF DESCRIPTION OF THE INVENTION

The purpose of the present invention is to provide an improved auxiliary eyeglass attachment method and apparatus

that has a secure attachment by use of magnets that effectively prevents the auxiliary eyeglasses from becoming detached from the conventional eyeglass without a need for additional support.

In the preferred embodiment of the invention the auxiliary eyeglasses are attached to conventional eyeglasses by magnets in a manner that prevents any downward or vertical movement that might cause the auxiliary eyeglasses to become detached. The method of attaching with magnets disclosed herein also provides a much easier method of securing the auxiliary glasses to the conventional eyeglasses as will be described in greater detail hereinafter.

It was thought, for example, as disclosed in the patent of Chao, Patent No. 5,568,207, that some support was needed to prevent the auxiliary eyeglasses from "moving downward" and coming off the conventional eyeglasses. However, what was not recognized was that magnets have a very strong attraction in a direction perpendicular to their axis. That is, with very strong magnets it is difficult to separate them by pulling them straight apart. Usually to separate them, particularly when they are very strong magnets, is by sliding them in a direction parallel to their mating surfaces. The reason for this is that the magnetic force is stronger in a direction perpendicular to the surface (i.e. the poles) of the magnets than it is to a direction parallel to the surface. The inventor of the auxiliary eyeglasses disclosed herein discovered that because of this principle

correctly oriented magnets can securely hold auxiliary eyeglasses on conventional frames without the need for additional support. The key is to orient the magnets so that any vertical force applied to the auxiliary frames will be perpendicular to the plane of the magnets.

To achieve this unique construction of appendages on opposite sides of the auxiliary frames including a socket for receiving magnets that are oriented with the plane of the magnets horizontal and the axis (i.e. poles) vertical or parallel to the auxiliary eyeglass frame. Complementary mating magnets are mounted in sockets on the hinge extensions on the conventional eyeglasses which are also oriented with the plane of the magnets horizontal and their axis (i.e. poles) vertical or approximately parallel to the plane of the conventional eyeglass.

This arrangement means the auxiliary eyeglasses may be easily mounted on the conventional eyeglasses without any fumbling or searching. The user doesn't have to feel with your fingers or remove the eyeglasses to be sure that the auxiliary eyeglass appendages are carefully aligned over the temple mounting extensions as with the arrangement described in U.S. Patent No. 5,568,207 referred to hereinabove. You simply place the auxiliary eyeglasses against the conventional eyeglasses with a slight upward motion and they easily attach when the magnets come into close proximity. This arrangement makes for a securely attached auxiliary eyeglasses and frame that is simple and easy to use without the difficulties with the other auxiliary eyeglass designs.

One can easily see the auxiliary eyeglasses approaching the conventional eyeglasses with the appendages on the auxiliary eyeglasses below the temple of the conventional eyeglass frame. Then with a very slight upward movement the magnets attract and the auxiliary eyeglass frame is firmly attached. This can be done simply and easily with one hand without any feeling or fumbling that previous arrangements required. The orientation is nearly automatic and doesn't require the more careful alignment that is required of other magnetically fastened auxiliary eyeglasses.

In an optional but less preferred embodiment, clips can provide additional support if desired. This, for example, might be used where very small magnets are used to attach the eyeglasses to the frames. In this embodiment a combination of the clip shown and described in applicant's prior Application Serial No. 08/510,797 filed August 3, 1995 or similar to that shown in the other patents can be attached to the auxiliary eyeglass frame. A clip would be incorporated into the bridge of the auxiliary eyeglass frame which would fit over and engage the conventional eyeglass bridge. This would lock the auxiliary eyeglass frame on the conventional eyeglass frame with the magnets holding the sides in place.

In still another optional but less preferred embodiment, a magnet could be provided beneath the bridge of a conventional eyeglasses to mate with a similar magnet on top of the bridge of the auxiliary eyeglass frame. In this

embodiment clips would be attached on top of or in the temple region of the auxiliary eyeglass frame that would fit over and engage the conventional eyeglass frame. In this embodiment the auxiliary eyeglass would be mounted by sliding the clips over the conventional eyeglass frame then pushing down on the bridge so that the magnet on the bridge slides under the bridge of the conventional eyeglass frame mating the magnets. The magnets in the bridge hold the auxiliary eyeglasses onto the frame of the conventional eyeglasses with the clips securely locking it in place.

The above and other novel features of the invention will be more fully understood from the following detailed description and the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an isometric view illustrating the method and apparatus for attaching an auxiliary eyeglass frame to conventional eyeglasses with magnets alone.

Figure 2 is an isometric view illustrating the auxiliary eyeglass frame attached to a conventional eyeglass frame with magnets alone.

Figure 3 illustrates the connection of the auxiliary eyeglass frame by magnets embedded in an appendage mating with similar magnets embedded in the temple extension of a conventional eyeglass frame.

Figure 4 illustrates an optional embodiment in which a clip formed on the bridge of the auxiliary eyeglass frame fits over and engages the bridge on the conventional eyeglass frame.

Figure 5 shows the embodiment of Figure 4 mounted on a conventional eyeglass frame.

Figure 6 is a sectional view taken at 6-6 of Figure 5.

Figure 7 is another embodiment in which magnets are embedded in the bridge of the auxiliary eyeglass frame for mating with magnets mounted beneath the bridge of a conventional eyeglass frame and including clips for locking the auxiliary eyeglass frame onto the conventional eyeglass frame.

Figure 8 illustrates the method of mounting the auxiliary eyeglass frame of Figure 7 on a conventional eyeglasses.

Figure 9 illustrates the embodiment of Figure 7 with the auxiliary eyeglass firmly secured on a conventional eyeglass frame.

Figure 10 is a sectional view taken at 10-10 of Figure 9.

DETAILED DESCRIPTION OF THE INVENTION

A unique method and construction for attaching auxiliary eyeglasses 10 to conventional eyeglasses 12 is illustrated in Figures 1 through 3. Auxiliary eyeglasses 10 are most commonly tinted eyeglasses to convert conventional eyeglasses 12 to sunglasses but also can have different prescription lenses. Auxiliary eyeglasses 10 has lenses 14 mounted in a frame 16 having appendages 18 extending rearward on either side of frame 16. Conventional eyeglasses 12 have a frame 20 with a bridge 22 with temple extensions 22 on either side of frame 20 for attaching

temples 24 to the frames.

In the auxiliary eyeglasses of the prior art magnets are either embedded in frame 20 or in extension on auxiliary eyeglasses that extend over or above the temple extensions 22 of the eyeglass frame 20. With the prior art constructions of magnets embedded in frames 20 the plane of the magnets is vertical or parallel to the lenses facilitating detachment of the auxiliary eyeglasses by a downward shearing force. To solve this problem the auxiliary eyeglasses of U.S. Patent No. 5,568,207 proposed putting magnets in auxiliary eyeglass extensions that fit over or above the temple mounting extensions on the eyeglass frame. It was thought that some support in addition to the magnets was needed to prevent the auxiliary eyeglasses from becoming detached. While this is a satisfactory solution it is not the best solution. The auxiliary eyeglasses must be carefully positioned above the conventional eyeglass frame to be sure the extensions are above the temples.

The present invention not only provides a solution to the potential detachment or dislodging of auxiliary eyeglass frames 10 but simplifies the method of mounting the auxiliary eyeglass with minimum fuss. This is achieved by inserting magnets 26 in sockets 28 in appendages 18 attached to auxiliary eyeglass frame 16. Complementary magnets 30 are mounted in sockets 32 attached to conventional eyeglass frame 20 temple extensions 22. Preferably magnets 26 and 30 are at least four millimeters (4 mm) in diameter.

An important and critical feature of the invention is

the orientation of magnets 26 and 30, which is shown more clearly in sectional view of Figure 3. Generally magnets have plane surfaces and axis. In this case magnets 26 and 30 are shown as cylindrical having an axis 34 that is vertically oriented and is approximately parallel to auxiliary frame 16 and conventional eyeglass frame 20. This means the maximum magnetic attractive force is vertically oriented along axis 34. Accordingly the maximum magnet force of magnets 26 and 30 is vertically oriented to resist dislodging of auxiliary eyeglass frame 10 by a downward movement. It was found that by mounting magnets 26 and 30 approximately 4 mm in diameter having a strong magnetic force vertically oriented is sufficient to hold auxiliary eyeglass frame 10 in place and prevent downward movement. Thus, auxiliary eyeglass frame 10 is securely mounted on conventional eyeglasses 12 and will not easily dislodged by strenuous activity occurring in sports or exercising.

Shearing forces along interface 36 are minimal and would more likely cause conventional eyeglasses 12 to fall off the wearer before auxiliary eyeglasses 10 would be dislodged. This construction not only improves the attachment of auxiliary eyeglasses 10 but also makes it easy for them to be mounted as illustrated in Figure 2. Auxiliary eyeglasses 10 can merely be brought up to conventional eyeglasses 12 with a slight upward motion until magnet 26 is attracted to magnet 30 and locks in place. Thus, they can easily be oriented and mounted on conventional eyeglasses 12 without the need to remove conventional eyeglasses from the wearer.

An optional but less preferred embodiment is illustrated in Figures 4 through 6. In this embodiment auxiliary eyeglasses 10' have appendages 18 with magnets 26 installed in sockets 28 as before. Magnets 26 mate with magnets 30 mounted in sockets 32 on conventional temple extensions 22 on conventional eyeglass frame 20 as before. However, to provide additional security and hold auxiliary frame 10' on conventional eyeglass frame 20, bridge 38 of auxiliary eyeglass frame 40 is formed with a clip 42 constructed to extend over and mount on conventional eyeglass bridge 44. Clip 42 will provide additional support for auxiliary eyeglasses 10' for use in extremely strenuous activity, for example, in cases where sports activities are such that conventional eyeglasses 12 are secured to the head of the wearer with straps that wrap around the back of the head. As shown in Figure 6 clip 42 formed on auxiliary eyeglass bridge 38 fits securely over bridge 44 on conventional eyeglass frame 20.

To mount the auxiliary eyeglasses 10' of Figure 4, they are placed against the conventional eyeglasses 12 and slid gently upward until magnet 26 mates with magnet 30. Clip 42 formed in bridge 38 of auxiliary frame 40 is then slipped over a conventional eyeglass bridge 44 securely mounting eyeglasses 10' on conventional eyeglasses 12.

Another embodiment utilizing the combination of magnets and clips to securely mount auxiliary eyeglasses on conventional eyeglasses is illustrated in Figure 7 through 10. In this embodiment auxiliary eyeglasses 50 are formed

with clips 52 mounted on the eyeglass frame 54 on the upper quadrant of the frame. Magnets 56 are secured in bridge 58 joining auxiliary eyeglass lenses 60. Conventional eyeglasses 62 are formed with frame 64 having a bridge 66 having complementary magnets 68 mounted in the bridge. In this embodiment auxiliary eyeglasses 50 are mounted on conventional eyeglasses 62 by the combination and opposing forces of clips 52 fitting over frame 70 of conventional eyeglasses 62 and bridge 58 fitting beneath bridge 66 so that magnets 56 in bridge 66 mate.

The installation of auxiliary eyeglasses 50 on conventional eyeglasses 62 is illustrated in Figures 8 and 9. Clips 52 on the upper quadrant of auxiliary lens frame 54 fit over conventional eyeglass frame 70 as shown in Figure 8. Auxiliary eyeglass bridge 58 is sufficiently flexible that bridge 58 can be pushed beneath bridge 66 on conventional eyeglass frame 62 allowing magnets 56 to mate with magnets 68 embedded in conventional eyeglass bridge 66. Thus, auxiliary eyeglasses 50 are securely mounted on conventional eyeglasses 62 as illustrated in Figure 9 and held in place by the opposing forces of clips 52 and magnets 56 and 68. Again, this construction would perhaps be best where extremely strenuous activity is involved that requires conventional eyeglasses 62 to be secured on the head of the wearer with a strap.

However, for most sports activities and exercising the construction disclosed and described with respect to Figures 1 through 3 is sufficient to mount auxiliary eyeglasses 10

on conventional frames 12. The key feature here is the orientation of magnets 26 and 30 so that the maximum magnetic attractive force along their axis (i.e. poles) 34 is vertically oriented or parallel with conventional eyeglass frame 20. In most cases only a substantial shearing force parallel to the interface 36 between magnets 26 and 30 could dislodge auxiliary eyeglasses 10 but then that force would probably dislodge conventional eyeglasses 12 from the head of the wearer.

Thus there has been disclosed novel and unique methods for attaching auxiliary eyeglass to conventional eyeglasses. In one embodiment, magnets having an orientation such that their maximum magnetic force is vertical or parallel with conventional eyeglass frame is sufficient to hold the auxiliary eyeglasses securely on the conventional eyeglasses.

In another less preferred embodiment a clip is attached to or integrally formed on the bridge of the auxiliary eyeglass frame for fitting over and securing the auxiliary eyeglasses to the bridge of the conventional eyeglasses.

In yet a third but less preferred embodiment a combination of clips and magnets are employed to mount auxiliary eyeglasses on conventional eyeglasses. In this third embodiment clips are formed in an upper quadrant on the frame of the auxiliary eyeglasses that fit over the frame of the conventional eyeglasses. Magnets embedded in the bridge of the conventional eyeglasses mate with magnets embedded in the bridge of the auxiliary eyeglasses such as

the auxiliary eyeglass bridge fits beneath the conventional eyeglass bridge.

This invention is not to be limited by the embodiment shown in the drawings and described in the description which is given by way of example and not of limitation, but only in accordance with the scope of the appended claims. --

WHAT IS CLAIMED IS:

1. A method of attaching auxiliary eyeglasses to conventional eyeglasses comprising;

a plurality of magnets mounted on said conventional eyeglasses;

a plurality of magnets mounted on said auxiliary eyeglasses adopted to fit beneath and mate with said plurality of magnets on said conventional eyeglasses;

said plurality of magnets on said conventional eyeglasses and said plurality of magnets on said auxiliary eyeglasses being mounted to orient the maximum magnet attractive force vertically approximately parallel to the plane of lenses in said conventional eyeglasses;

whereby said auxiliary eyeglasses are prevented from moving downward and being displaced when mounted on said conventional eyeglasses by said attractive force between said magnets.

2. The method according to Claim 1 comprising mounting said plurality of magnets in said conventional eyeglasses in temple extensions of a frame of said conventional eyeglasses; and mounting said plurality of magnets on said auxiliary eyeglasses in appendages that extend from apposite sides of a frame of said auxiliary eyeglasses.

3. The method according to Claim 2 comprising mounting a plurality of cylindrical magnets with their axis vertically oriented parallel to the lenses of said conventional eyeglasses; and mounting a plurality of mating cylindrical magnets with their axis vertically oriented

parallel to the lenses of said auxiliary eyeglasses whereby the maximum magnetic attractive force prevents detachment of said auxiliary eyeglasses from said conventional eyeglasses by downward movement.

4. The method according to Claim 3 including forming clip means on a bridge of said auxiliary eyeglasses for fitting over a bridge of said conventional eyeglasses.

5. The method according to Claim 4 in which said clip means is integrally formed in said auxiliary eyeglass bridge.

6. Apparatus for attaching auxiliary eyeglasses to conventional eyeglasses comprising;

mounting means mounting a plurality of magnets on said conventional eyeglasses;

mounting means mounting a plurality of magnets on said auxiliary eyeglasses for mating beneath said plurality of magnets on said conventional eyeglasses;

said plurality of magnets on said conventional eyeglasses and said mounting plurality of magnets on said auxiliary eyeglasses being oriented such that the maximum magnetic attractive force between said magnets is oriented vertically parallel to lenses in said-conventional eyeglasses;

whereby said plurality of magnets on said auxiliary eyeglasses when mated beneath said plurality of magnets on said conventional eyeglasses provides maximum resistance to downward movement of said auxiliary eyeglasses thereby preventing said auxiliary eyeglasses from detaching from

said conventional eyeglasses.

7. The apparatus according to Claim 6 in which said plurality of magnets on said conventional eyeglasses are attached to temple mounting extensions on a frame of said conventional eyeglasses; and said plurality of magnets on said auxiliary eyeglasses are mounted on appendages on said auxiliary eyeglasses adapted to fit beneath said temple extension on said frame of said conventional eyeglasses.

8. The apparatus according to Claim 7 in which said plurality of magnets on said conventional eyeglasses and said plurality of magnets on said auxiliary eyeglasses are cylindrical magnets having their axis oriented vertically parallel to lenses in said conventional eyeglasses and auxiliary eyeglasses respectively.

9. The apparatus according to Claim 8 including clip means on a bridge of said auxiliary eyeglasses adapted to fit over a bridge on said conventional eyeglasses to provide additional support to said auxiliary eyeglasses when mounted on said conventional eyeglasses.

10. The apparatus according to Claim 9 in which said clip is integrally formed on said bridge of said auxiliary eyeglasses.

11. Apparatus for mounting auxiliary eyeglasses on conventional eyeglasses comprising;

clip means formed on a frame of said auxiliary eyeglasses adapted to fit on a frame of said conventional eyeglasses; and

magnetic means on a bridge of said conventional

eyeglasses;

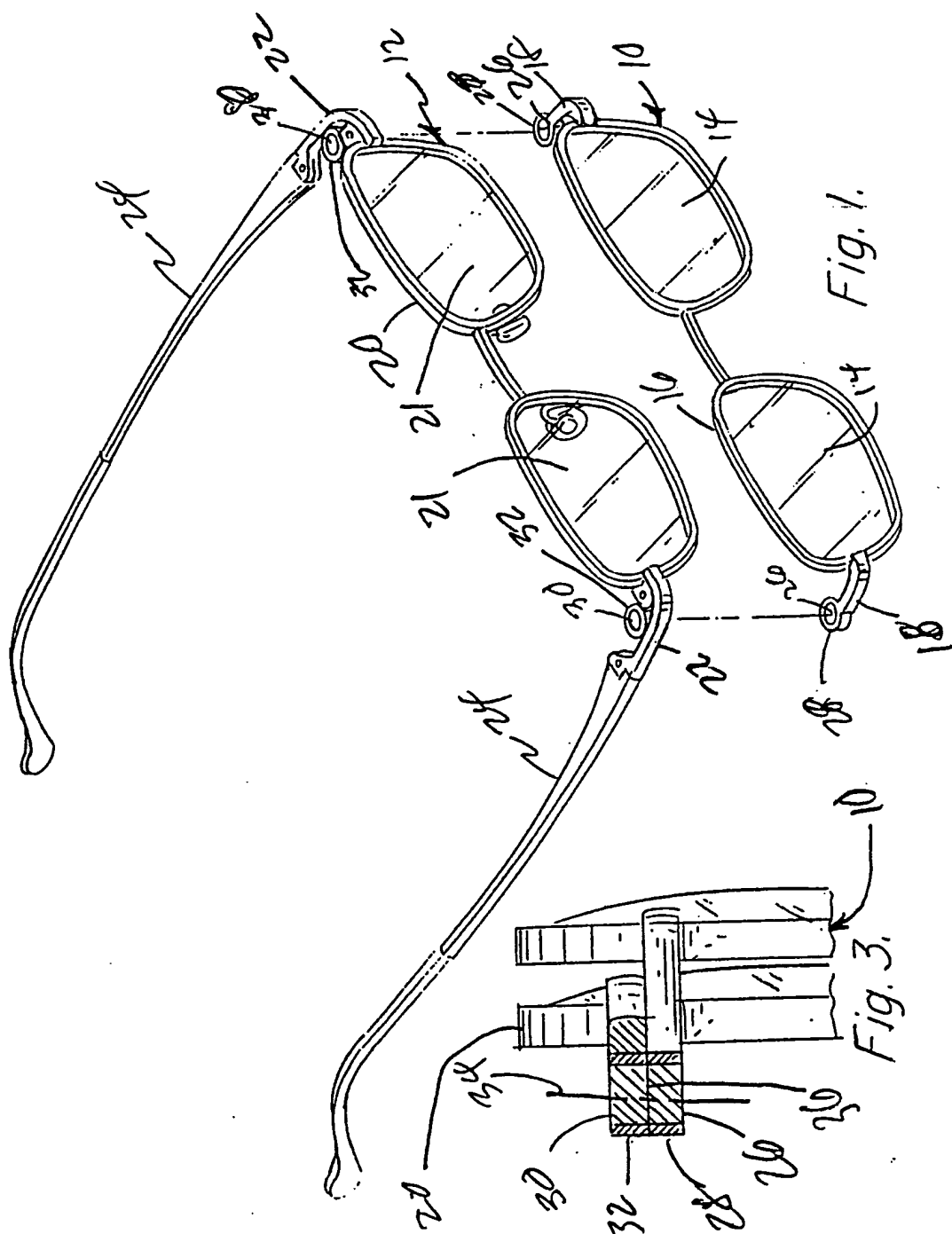
magnetic means on a bridge of said auxiliary eyeglasses adapted to fit beneath and mate with said magnetic means on a bridge of said conventional eyeglasses in opposition to said clip means on said frame of said auxiliary eyeglasses;

whereby said clip means and magnetic means on said auxiliary eyeglasses securely holds said auxiliary eyeglasses on said conventional eyeglasses.

12. The apparatus according to Claim 11 in which said clip means comprises a pair of clips mounted on an upper quadrant edge of said auxiliary eyeglasses.

13. The apparatus according to Claim 11 in which said magnetic means mounted in a bridge of said conventional eyeglasses and said bridge of said auxiliary eyeglasses comprises magnets embedded in said respective bridge of said conventional eyeglasses and auxiliary eyeglasses.

14. The apparatus according to Claim 13 in which said magnets embedded in said respective bridge of said conventional eyeglasses and auxiliary eyeglasses comprises a pair of magnets.



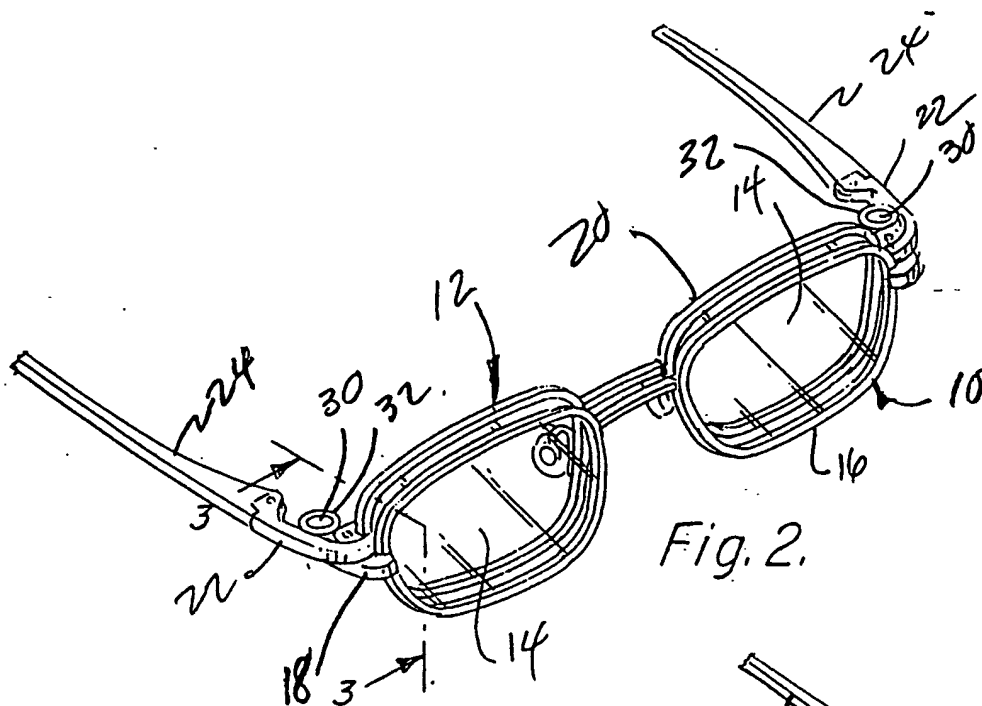


Fig. 2.

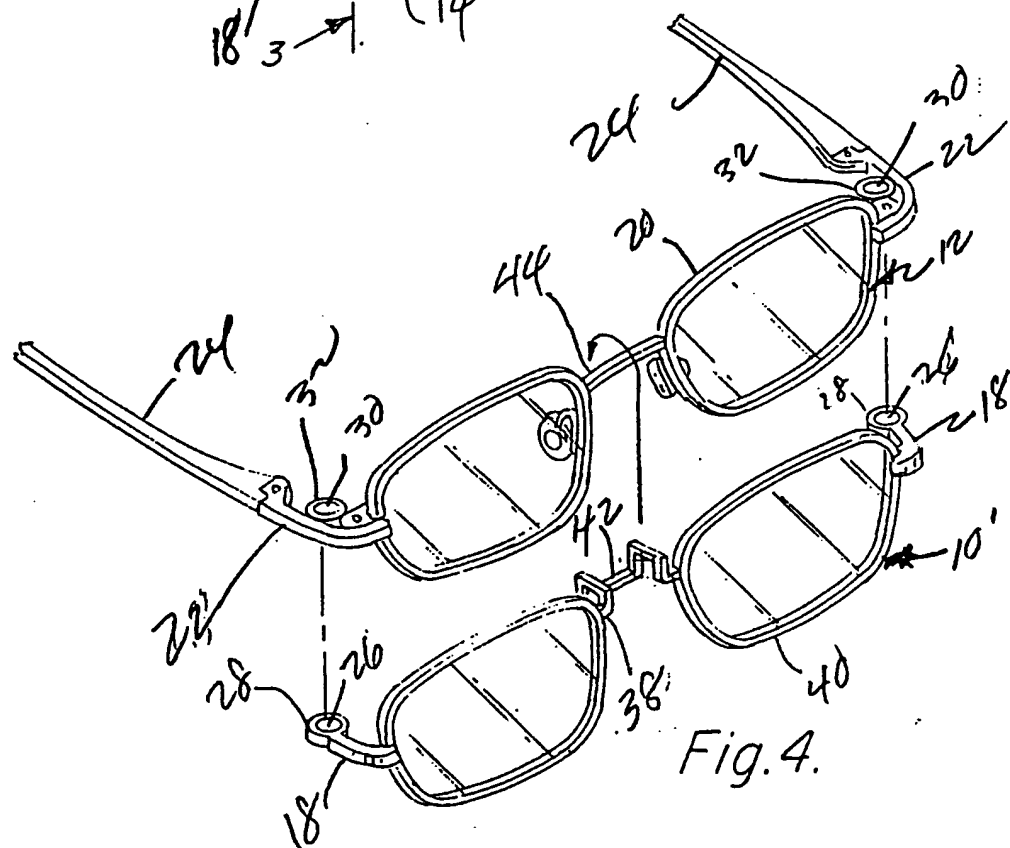


Fig. 4.

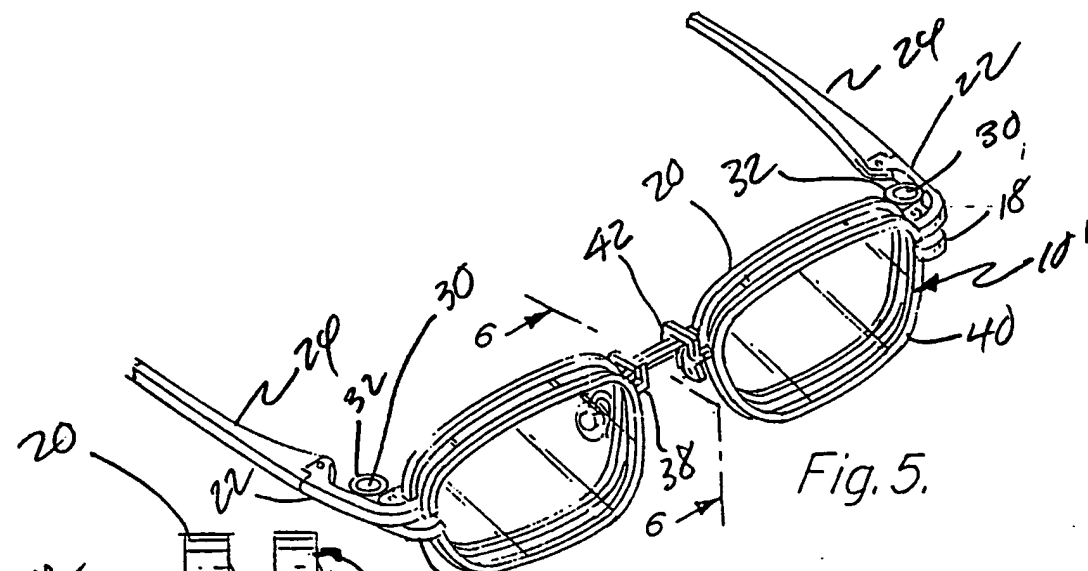


Fig. 5.

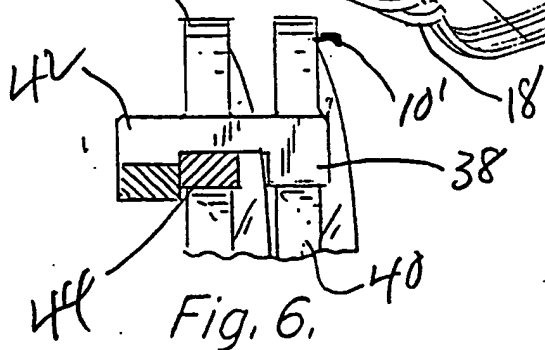


Fig. 6.

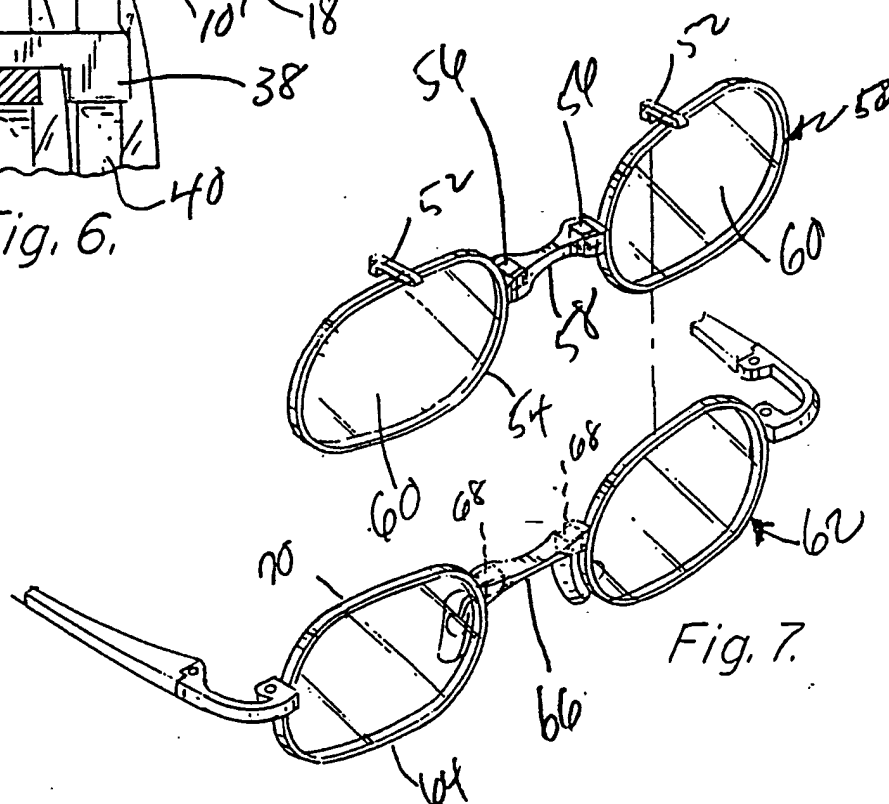
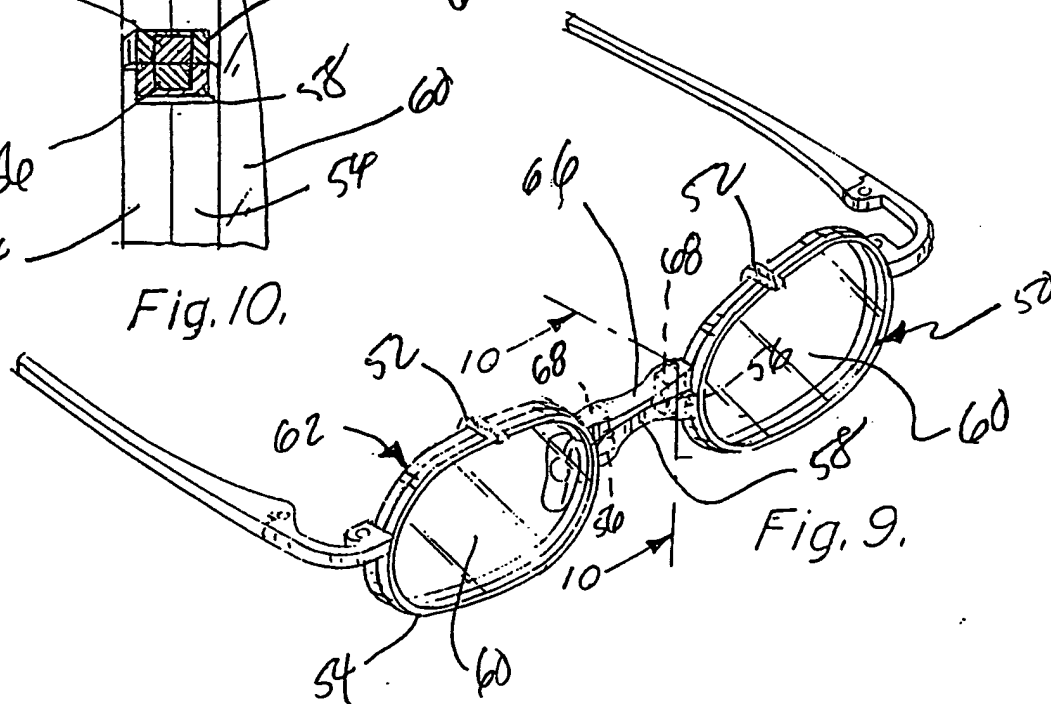
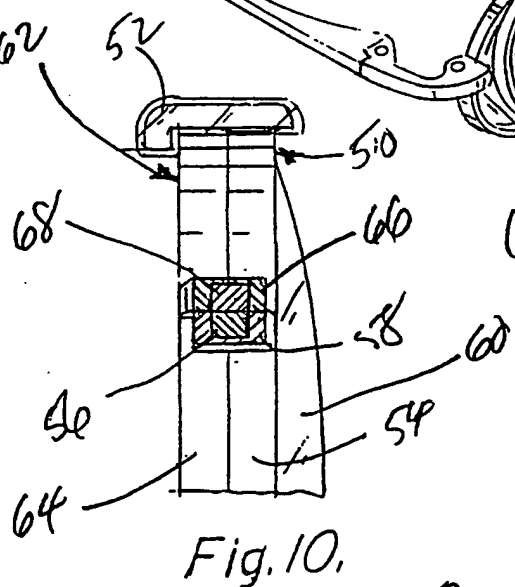
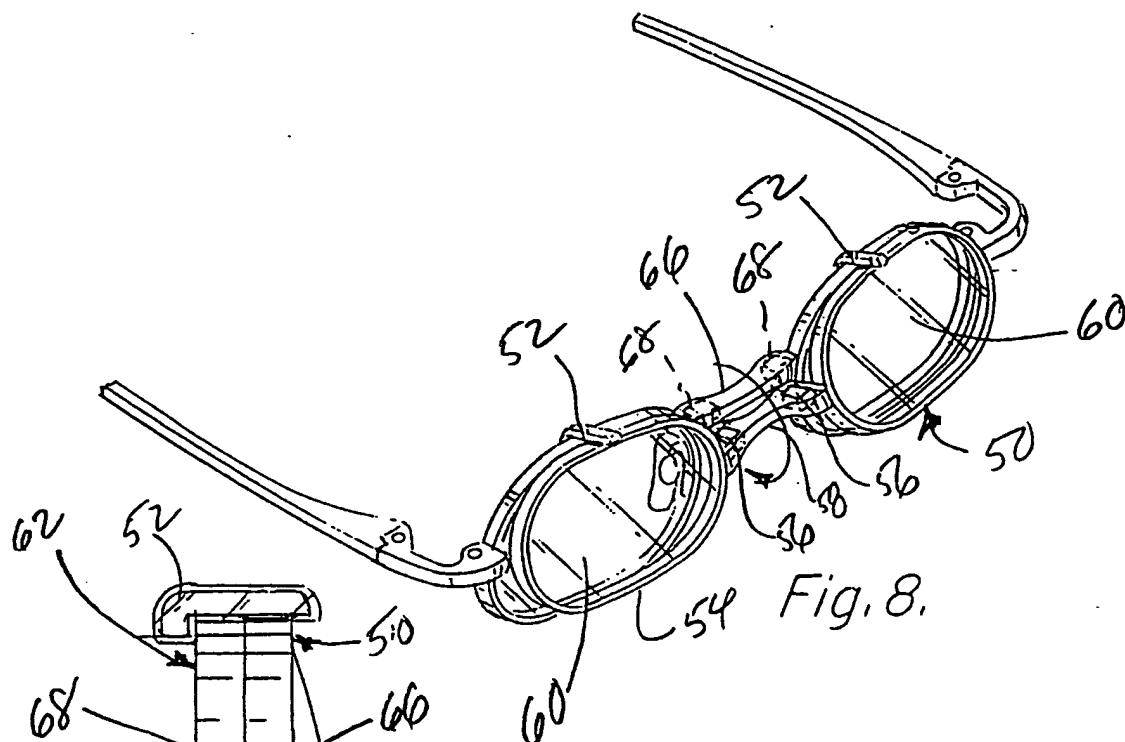


Fig. 7.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/25420

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G02C 9/00, 7/08

US CL : 351/47, 57

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 351/47, 57

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,568,207 A (CHAO) 22 October 1996 (22.10.96), see entire document.	1-3,6-8
A	US 5,696,571 A (SPENCER et al) 9 December 1997 (9.12.97), see entire document.	1-14

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Further documents are listed in the continuation of Box C.

☐

See patent family annex.

* Special categories of cited documents:	* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Z* document member of the same patent family
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P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

18 DECEMBER 1999

Date of mailing of the international search report

02 FEB 2000

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